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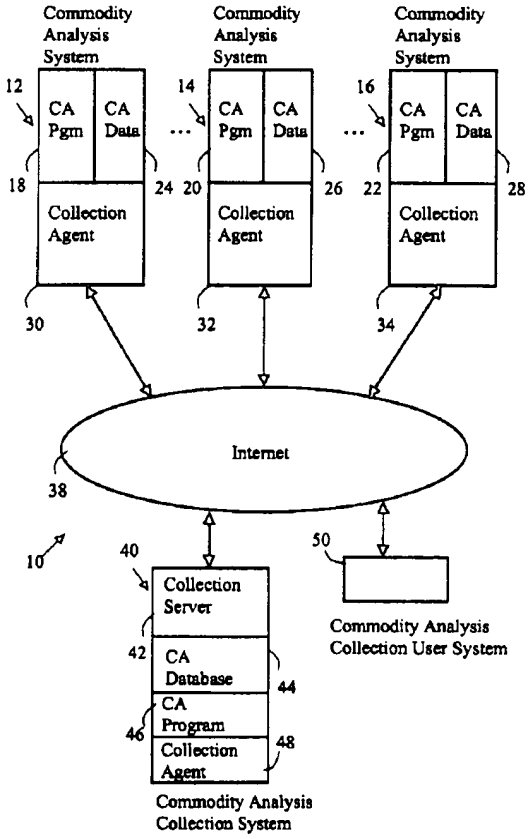


(57) Abrégé/Abstract:
There is provided a computerized method and system for managing commodity data for a chain of production in which one or

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(57) Abrégé(suite)/Abstract(continued):
more commodities are used in one or more production steps. Commodity data for a particular quantity of a commodity are generated by commodity analysis systems at points in the supply chain and provided to a central data storage system. The commodity data may be traced as the particular quantities of the commodity flow through the chain of production. The commodity data preferably includes commodity characteristics defined in accordance with commodity standards such as specialty trait tracking programs, identity preservation programs and food safety programs in the agri-food industries.

# METHOD AND SYSTEM FOR MANAGING COMMODITY INFORMATION IN A SUPPLY CHAIN OF PRODUCTION

## TECHNICAL FIELD

The invention pertains to a method and system for managing commodity information as a commodity flows through a supply chain of production.

## BACKGROUND OF THE INVENTION

In many supply chains of production, a commodity is sourced from at least one entity, processed in one or more steps and, typically, transferred between one or more entities in the supply chain. A discrete quantity of a commodity (e.g. a lot) may be acquired, blended with other lots, refined, transported, or combined with one or more other lots of other commodities. Increasingly, to meet a variety of producer and consumer interests, there is a need to determine and track commodity characteristics through the supply chain, particularly as a commodity moves between entities in such a chain.

In the agricultural commodity industries including animals and crops such as grain, fruit and vegetables as well as other commodities derived therefrom, such as meat, flour, food pellets, etc., the commodities are classified according to certain characteristics. Often, there is a need to determine one or more inherent characteristics of a particular commodity in order to further determine a quality characteristic or other standard measure for the commodity. Rudimentary methods for determining commodity characteristics include the visual inspection of the commodity and, typically, a subjective comparison to a

defined standard. However, more sophisticated computerized detection and comparison methods are also known.

By way of example, the Canadian Grain Commission (CGC) regulates the quality of all grains in Canada. One aspect of grain analysis in Canada is the determination of the Kernel Visual Distinctiveness (KVD) of wheat varieties. This measure helps to track varieties that have specific baking characteristics. CGC monitors customers' needs and adjusts the CGC grading structure according to market demands. CGC also offers an inspection service that is used by grain elevator operators and the Canadian Wheat Board (CWB). A CGC grain inspector evaluates samples of a grain shipment visually to determine grain characteristics and compares the characteristics to the CGC standard. Elevator operators purchase grain from farmers on behalf of the CWB. The elevator operators may blend grain from several farmers in order to produce an amount of grain that meets a predefined quality grade level. The price for such grain paid to the farmer by the elevator operator and to the elevator operator by the CWB is determined, in part, by the grade of the grain.

Grain shipments are analyzed numerous times between field and market. For example, grain is analyzed by the CGC at the farmer's local elevator before it is loaded for transporting and is evaluated again when received on behalf of the CGC. Grain elevator operators risk that the grade evaluation may not be the same at the receiving end as it was at its origin. When a grain shipment is evaluated to a lower grade, the elevator operator receives less money than expected from the CWB; however, compensation cannot be sought from the farmer.

Although the CGC's grading system is very precise, it is difficult to implement. This can be attributed to sampling bias and the subjectivity of the visual inspection by different inspectors on different days.

Computerized analysis systems to determine one or more characteristics of a commodity are well known. For example, United States Patent No. 6,324,531 issued Nov. 27, 2001 of Anderson et al. discloses a system for identifying the geographic origin of a fresh commodity. The system analyzes samples of the commodity for elemental concentrations. It also employs a neural network model and a bootstrap aggregating strategy to determine a classification of each sample indicative of the sample's origin. United States Patent No. 5,917,927 issued June 29, 1999 of Satake et al. discloses an apparatus and method for the inspection of rice and other grains to determine broken rice content. United States Patent No. 5,321,764 issued June 14, 1994 discloses the identification of wheat cultivars by computerized visual imaging analysis.

In view of the dispersed nature of the production and distribution of agricultural commodities, and, often, the perishable nature of the commodity, it is generally impractical to conduct analyses using only one instrument. As noted, grain requires analysis at several locations over a wide geographic area in a relatively short time frame. Therefore, commodity analysis systems are usually distributed widely and may be positioned throughout the supply chain in various locations. In some cases, more than one commodity analysis system may exist at a single test location.

While these respective commodity analysis systems facilitate a more objective determination of the one or more characteristics of the respective commodities to which the systems are directed, each system tends to operate autonomously. The systems are not coupled to provide the analysis data resulting from the tests to one another or to a collection system. The analysis data is not conveniently available for correlation or for review by users and others interested in the commodity.

Increasingly, a variety of identity preservation, specialty trait tracking and food safety certification programs are being adopted for a variety of commodities. Such programs impose one or more specifications defining standards for commodity characteristics for products used or produced in a supply chain. For example, a program may require the identification of the variety of a particular discrete quantity of a commodity as comprising a non-genetically modified organism (non-GMO). In addition to defining standards for the commodity itself, some programs mandate standards of production for the commodity. Such standards may relate to growing or raising conditions as well as to other production and processing conditions. Many food safety and other certification programs mandate such standards.

To adhere to the standards, for particular quantities of the commodity used or produced in the supply chain, the required commodity must be analyzed and the characteristics identified. Thereafter, those quantities that meet the standard are segregated from other quantities whose characteristics cannot be assured. Further, as those quantities move through the supply chain, the

characteristics are monitored to preserve adherence to the standards.

There is therefore a need for a system and method to manage commodity data in a chain of production.

## SUMMARY OF THE INVENTION

There is provided a system for and method of managing commodity data for a chain of production in which one or more commodities are used in one or more production steps.

In accordance with an aspect of the invention, the method comprises the steps of receiving commodity data for discrete quantities of at least one commodity used or produced by the chain of production, storing the commodity data in a data storage system; and determining commodity information in accordance with the contents of the data storage system. The commodity data comprises, for each particular discrete quantity of one of the commodities, at least one commodity characteristic of the particular discrete quantity. The commodity data is received from one or more commodity analysis systems each configured to analyze one or more commodities to determine at least one commodity characteristic and generate commodity data.

The method may further comprise providing the commodity information for determining a use of at least a portion of at least one of the discrete quantities in the chain of production. Preferably, the use is defined in accordance with a standard responsive to one or more commodity characteristics. It is a further preference that the standard defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program. The step of determining commodity

information may include the step of tracing commodity data through said chain of production.

In accordance with this method aspect of the invention the commodity data is received from one or more commodity analysis systems. Each commodity analysis system is configured to analyze one or more commodities to provide measurement data for each commodity analyzed; examine the measurement data to determine at least one commodity characteristic; and generate the commodity data for particular discrete quantities of the one or more commodities. Preferably, the commodity analysis systems are configured to examine measurement data in accordance with a library of comparative data for determining commodity characteristics. In such as case, the commodity analysis systems may be configured to use one or more neural networks for determining commodity characteristics. The method may include a step of providing electronically an update for the configuration of at least one of the commodity analysis systems.

In accordance with a further aspect of the invention there is another method of managing commodity data for a chain of production in which one or more commodities are used in one or more process steps. This method comprises the steps of generating commodity data for a plurality of discrete quantities of at least one commodity used or produced by the chain of production; providing the commodity data for storing in a data storage system configured for receiving commodity data from a plurality of commodity analysis systems. The commodity data for each particular discrete quantity comprises at least one commodity characteristic

produced by analyzing the particular discrete quantity using a commodity analysis system.

The method may further comprise determining a use in the chain of production of at least a portion of at least one of the discrete quantities in response to said commodity data stored in the data storage system. Preferably, the use is determined in accordance with the compliance with a standard of one or more commodity characteristics for a particular discrete quantity of a commodity. The standard may define one of an identity preservation program, a specialty trait tracking program and a food safety certification program. The step of determining commodity information may comprise tracing commodity data through said chain of production.

In accordance with a feature of this method, the commodity analysis systems are configured to analyze one or more commodities to provide measurement data for each commodity analyzed; examine said measurement data to determine at least one commodity characteristic; and generate the commodity data for particular discrete quantities of the one or more commodities. In such a case, the commodity analysis systems may be configured to examine the measurement data in accordance with a library of comparative data for determining commodity characteristics and the commodity analysis systems may be configured to use one or more neural networks for determining commodity characteristics.

In accordance with this method, the step of generating commodity data may include the step of entering commodity data using a user interface of the commodity analysis system. In such a case , the method may include the step of

correlating commodity data entered using the interface with commodity data produced by an analysis.

Preferably, at least one commodity analysis system is configured to periodically gather commodity data from a plurality of commodity analyses into a batch of commodity data. The step of providing may then comprise transmitting the batch to the data storage system.

In accordance with another aspect of the invention, there is provided a method of managing a commodity analysis system for generating commodity data for a chain of production in which one or more commodities are used in one or more process steps. This method comprises the steps of receiving commodity data for discrete quantities of at least one commodity used or produced by the chain of production from one or more commodity analysis systems each configured to analyze one or more commodities to determine at least one commodity characteristic and generate the commodity data for particular discrete quantities of the one or more commodities; storing the commodity data in a data storage system; and tracking the use of at least one of the commodity analysis systems. The commodity data comprises, for each particular discrete quantity of one of the commodities, at least one commodity characteristic of the particular discrete quantity.

The method may including a step of transmitting an update for at least one of the commodity analysis systems. Preferably, such an analysis system comprises a neural network for determining the at least one commodity characteristic and the update comprises an update to the neural network.

The method may also include the step of invoicing in response to the tracked use of the at least one commodity analysis system.

There is further provided in accordance with yet another aspect of the invention a method of managing commodity data for a chain of production in which one or more agricultural commodities are used in one or more production steps. This method comprises the steps of receiving commodity data for discrete quantities of at least one agricultural commodity used or produced by the chain of production; storing the commodity data in a data storage system; and determining commodity information in accordance with the contents of the data storage system. Accordingly, the commodity data comprises, for each particular discrete quantity of one of the agricultural commodities, at least one commodity characteristic of the particular discrete quantity and the commodity data is received from one or more commodity analysis systems each configured to analyze one or more agricultural commodities to determine at least one commodity characteristic and generate commodity data. As well the one or more agricultural commodities comprise at least one of a crop, an animal, a commodity derived from a crop and a commodity derived from an animal.

This method may include the step of providing the commodity information for determining a use of at least a portion of at least one of the discrete quantities in the chain of production. Preferably, the use is selected in accordance with a standard responsive to one or more agricultural commodity characteristics, such as a standard defining one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

The method step of determining commodity information may include the step of tracing commodity data through said chain of production to examine whether a use of a particular discrete quantity of an agricultural commodity is in compliance with a standard defining one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

In accordance with a further aspect, there is provided a computerized system for managing commodity data for a chain of production in which one or more commodities are used in one or more process steps. The system comprises a data storage system for storing commodity data for a plurality of discrete quantities of at least one commodity used or produced by the chain of production, the commodity data for each particular discrete quantity comprising an at least one commodity characteristic; and a plurality of commodity analysis systems coupled to the data storage system for generating commodity data to be stored by the data storage system, each commodity analysis system operating under control of a program to perform commodity analysis and storage operations as identified by the program; and each commodity analysis system including at least one instrument for analyzing the commodity for determining the at least one commodity characteristic.

The commodity analysis system may further comprise a user interface for receiving commodity data for storing in the data storage system in association with commodity data determined by analysis.

Preferably, a commodity analysis system further comprises a user interface for retrieving commodity information from the data storage system. The commodity information may be

retrieved for determining a use in the chain of production of at least a portion of at least one of the discrete quantities. The data storage system may be configured to enable tracing of commodity data as particular discrete quantities of a commodity flow through the chain of production.

As a feature of this aspect of the invention, the instrument may be configured for determining at least one commodity characteristic for evaluating compliance with a commodity standard, such as a commodity standard that defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

Preferably, the at least one commodity characteristic includes at least one measured characteristic of the particular discrete quantity and, preferably, the at least one commodity characteristic includes at least one secondary characteristic determined for the particular discrete quantity. The commodity data may include at least one production context characteristic of the particular discrete quantity.

In accordance with a preference of the system, the commodity analysis systems are configured to: analyze one or more commodities to provide measurement data for each commodity analyzed; examine said measurement data to determine at least one commodity characteristic; and generate commodity data for particular discrete quantities of the one or more commodities. The commodity analysis systems may be configured to examine the measurement data in accordance with a library of comparative data for determining commodity characteristics. In such a case, the

commodity analysis systems may be configured to use one or more neural networks for determining commodity characteristics. Further, at least one commodity analysis system may be configured to periodically gather commodity data from a plurality of commodity analyses into a batch and transmit the batch to the data storage system for storing the commodity analysis data.

## BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

Fig. 1 is a block diagram of a preferred embodiment of the system in accordance with the invention; and

Fig. 2. is a flowchart of a preferred embodiment of the method in accordance with the invention.

It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 illustrates a block diagram of a system 10 for managing commodity analysis data and information in accordance with a preferred embodiment of the invention. System 10 comprises at least one commodity analysis system (CAS) such as systems 12, 14 and 16 coupled for communication with a data storage system (i.e. commodity analysis collection system (CACS)) 40. In the preferred embodiment, CAS 12, 14 and 16 and the CACS 40 are coupled for network communication via the Internet 38. However, it

is understood that other public or private networks or combinations thereof may be employed, whether wired or wireless, sufficient to communicate signals between CACS 40 and each CAS 12, 14 and 16. Therefore, CAS 12, 14 and 16 may be positioned in remote locations from CACS 40, such as, in the case of grain analysis systems, at a farm, grain elevator, transportation port, mill, or other point in a chain of production.

Each CAS 12, 14 and 16 typically comprises a computer (e.g. a personal computer (PC)) including a programmable processor (not shown) coupled with one or more instruments, for example, an imaging sensor (not shown), for detecting at least one characteristics of at least one commodity. Preferably, each computer includes a display device such as a display monitor and one or more input devices, for example a keyboard, pointing device and the like for operating the computer (all not shown). The computer also includes a network interface device (not shown) for facilitating Internet communications and one or more storage devices (not shown) for storing programs and data such as an operating system and applications as described further below.

Each CAS processor may be programmed by a respective commodity analysis program (CA program) 18, 20 and 22. A CA program instructs steps for analyzing the output of the instrument(s) with which a processor is coupled and for determining one or more characteristics of the commodity giving CA data 24, 26 and 28. Further, the CA program may instruct steps for displaying the CA data to a user of the CAS and for locally storing the CA data as described further below.

A primary function of each CAS is the analysis of a commodity to determine one or more commodity characteristics of interest to members of the supply chain. It is understood that such characteristics may vary in accordance with the commodity as well as the member. Thus, each CAS is preferably configurable to determine a plurality of characteristics for any one commodity and preferably is configurable to analyze more than one commodity. The commodity characteristics determined by an instrument controlled by a CA program may include inherent characteristics such as color, weight, moisture content, shape, etc. and other commodity properties as well as secondary characteristics determined from such inherent measurable characteristics. Secondary characteristics may include variety, disease presence, quality or other valuations in accordance with one or more defined standards for a commodity. For example, a CAS may be configured for detection of grain varieties with specific traits such as genetically modified organism (GMO) varieties or other disease tolerances such as *Fusarium* tolerance described below.

While each CA program 18, 20 and 22 is illustrated schematically as a single item, it may comprise a plurality of parts such as software and data therefor. For example, the CA program may comprise software for operating the instrument to obtain instrument readings, for manipulating the instrument readings to obtain data for evaluation and for evaluating the data. The CA program may include a neural network software program and one or more libraries of training data defining commodity characteristics and/or standards against which the characteristics may be compared.

Additionally, each CA program 18, 20 and 22 defines a user interface (not shown) such as a graphical interface for operating the respective CAS 12, 14 and 16 as described further below. As well as determining CA data indicative of one or more characteristics of the commodity, the CA program 18, 20 and 22 is configured for receiving additional CA data 24, 26 and 28 through the user interface. Such additional data may comprise one or more identifiers for identifying the particular quantity of the commodity analyzed such as by lot identifier, storage location or a shipping identifier. The CA data may include other identifiers for the specific analysis such as the CAS location, one or more tests performed, date, grower and operator, etc.

Grower or other source data for a commodity received via the user interface may be extensive. Source data for crops may comprise identifiers for determining a grower's particular field, seed variety, soil conditions, fertilizer and other treatments used, and other inputs known to those skilled in the art. To avoid duplicitous entry, at least some of the grower data may be stored, as described further below, to permit correlation with subsequent commodity analysis and other data. For example, a CAS may be configured to set up entries for particular farms, fields or growers which may be correlated. For example, a field may be correlated with one grower one year and another grower another year to reflect new ownership or field use arrangements.

Source data may be useful in order to facilitate certain identity preservation, specialty trait tracking or certification programs through all or part of the supply

chain, for managing or planning for particular farms, for studying yield or other measures for a particular seed variety or fertilizer, etc. A CAS or other computer such as a computer 50 described below may be configured, as is understood to persons skilled in the art, with one or more tools or modules to assist with such data uses.

As it is intended in the preferred embodiment that a plurality of CAS will be distributed through out various points or stages in a supply chain, the CA data of interest to be collected at the various points may differ. A CAS that is used for analyzing a commodity as it is received from a grower or other source at an initial stage of a supply chain may be configured to receive different CA data than a CAS that is used to analyze the commodity at a subsequent stage in the supply chain. As is understood by persons skilled in the art, a CA program may be configured for use at one or more stages and may be user selective. Alternately, a CA program may be configured for dedicated use.

For communicating CA data 24, 26 and 28 to CACS 40 as described further below, each CAS 12, 14 and 16 further comprises a respective collection agent 30, 32 and 34.

CACS 40 comprises at least one computer, preferably configured to be suitable as a server and including one or more programmable processors, storage devices and network interface device(s) (all not shown) for storing programs and data therefore to receive CA data from each CAS 12, 14 and 16. As such, CACS 40 comprises a corresponding collection server 42 cooperating with the collection agents 30, 32 and 34. CACS further comprises a CA database 44 including data storage and an interface for storing,

retrieving and manipulating CA data received by collection server 42. CA database 44 preferably comprise a relational database well known to those skilled in the art.

In addition to facilitating the collection of CA data in CA database 44, CACS 40 provides a manner to access the collected CA database 44 for querying the database 44. Queries may generate reports including information determined from the CA data or may retrieve specific instances of CA data. CACS may further provide an interface to add further context data for correlation with specific CA data. General context data may include weather data or data indicating the known presence of certain commodity diseases in a general geographical area related to the CA data.

More specific context data may include further particulars for the commodity source (e.g. a grower history of disease incidence, farm or other inspection reports, summary of growing practices, etc.), shipping or other transportation or handling data from the particular lot of the commodity, etc.

User access to database 44 may be available through collection server 42 or another server (not shown). Preferably, CACS 40 provides a web-based user interface access method for receiving and answering queries to CA database 44. In the preferred embodiment, the web-based service is a subscription-type service available to registered users for a fee. Access to the CA database 44 through the service may be made via a CAS 12, 14 and 16. Access may also be made via other computers such as by a commodity analysis collection subscriber having a user computer 50 coupled to the Internet. Such users may

include, in the context of grain analysis for example, CGC, CLB, grain elevator companies, transportation providers, as well as grain users and purchasers among others in a supply chain for grain. Exemplary uses of CA data in database 44 are described further herein below.

Optionally, CACS 42 also includes the current versions of CA program 46 and collection agent 48 for distribution to a CAS to ensure the CAS is up to date as described further below.

Fig. 2 illustrates a flowchart of a method of managing commodity information in accordance with the invention. At step 100, a CAS operator performs a commodity analysis to determine one or more characteristics of a commodity. Preferably, the operator gains access to the CAS through a password-protected user interface. To analyze a grain sample, for example, the grain sample may be deposited into a feeding mechanism for the sensor. Using a touch screen or other pointing-like interface, the operator selects the tests to be performed by the CA Program of the CAS. The analysis is performed, generating CA data stored locally on the CAS representative of the determined characteristics of the commodity and data to identify the analysis.

Analysis may involve the exemplary steps of:

Capturing a digital image of the grain sample that has a particular resolution;

Digitizing the image to create individual datasets for each seed in the image;

Providing the datasets for interpretation by a neural network;

Determining one or more characteristics of the seed by the neural network in accordance with the selected tests;

Presenting the analysis results on a display and making the results available for printing; and

Storing the results.

Additional data may be entered by the operator for identifying the sample analysis as discussed previously.

Preferably, only relevant information will be retained from each analysis - for example, the digital images need not be stored for future use.

Additional analyses may be selected and conducted throughout the day and the CA data therefor stored locally on a storage device coupled to the CAS computer.

Periodically and preferably at regularly scheduled times, selected CA data for the period (e.g. a day) are electronically transmitted via the Internet to CACS 40 for storing in central CA database 44 (steps 102 and 104). Preferably, prior to transmission, the CA data for each test are gathered in a batch. The batch may be compressed in accordance with a data compression protocol and/or encrypted in accordance with an encryption protocol all as understood to persons skilled in the art. Preferably, only relevant information selected from the CA data is transmitted for storage. The relevance of the data may be determined by persons skilled in the art with a view to the anticipated uses of the information by a variety of users. Preferably, the CA database 44 and any transmission protocol that may be employed for transmitting the batch data is flexible to account for different data required by different commodity tests.

Collecting CA data in batches facilitates off-line analysis and temporary collection at the CAS. Thus a CAS may be

portable for transporting to particular test locations such as a farm. Following one or more commodity analysis tests, the operator may connect the CAS to the Internet to transmit a batch.

At step 106, the transmitted batch is received by CACS 40. Preferably one or more integrity checks are performed to validate the received CA data, authenticating that the transmission is from an approved CAS and/or operator, etc. At step 108 the CA data is stored to CA database 44. Acknowledgement of the receiving and storing of the data may be transmitted to the CAS (not shown).

This stored CA data is thus available to subscribing users of the service, for example, by way of value-added reports. Step 110 illustrates an exemplary user query of database 44.

Subscribers such as various members in the supply chain can submit user queries to access CA data and correlated data and generate reports. In response to the user query, reports can be viewed online, downloaded and printed. Different subscribers to the service may have different access to information in CA database 44 in accordance with security and other parameters configured for the subscriber. For example, grain company head offices may have a wide degree of access to reports while elevator managers may have a lower level of access to reports from their own elevators. In accordance with conventional methods, access to the subscriber service should be secure to prevent unauthorized access to the database, the reports and subscriber information especially during transmission over the network.

The subscriber service may offer pre-defined reports or customizable reports as is well understood to persons skilled in the art. While it is contemplated that reports are generated in response to a subscriber request via a web-based interface, persons skilled in the art will recognize that other reporting mechanisms may be within the scope of the invention. For example, a subscriber may select to have a particular report generated periodically (e.g. monthly) and electronically transmitted to the subscriber such as via email.

The commodity analysis data managed and information therefrom may be used in a variety of ways by members of the supply chain. Upon initial receipt of a quantity of a commodity. CA data therefor may be used to determine a storage location for the commodity, for example, to segregated commodities with desired traits or in accordance with grade or other measures. Some members may use CACS 40 when determining a particular use for a commodity in the supply chain (step 112). For example, database 44 may be queried when combining (e.g. blending) quantities of a commodity in accordance with a standard for the commodity. Database queries may be performed to determine particular quantities of a commodity that exhibit (or do not exhibit) certain traits to facilitate blending. A user may desire a commodity that is free of a certain disease or comprises disease resistant varieties. Conversely, a user may wish to avoid certain varieties. Though not shown in Fig. 2, a blended commodity may be analyzed and CA data therefore stored in CA database 44. This CA data may be correlated to CA data from the particular commodities used to make the blend. Similarly other commodities used and produced in

the supply chain may be linked to facilitate ready tracking.

CA database 44 presents numerous other advantages. One such advantage is the facilitation of traceability. Traceability refers to the ability to track a commodity and thereafter recall its CA data as the commodity flows through a supply chain. In the grain industry, for example, grain from multiple sources may be blended and distributed widely for different uses. CA database 44 provides a manner in which to track CA data throughout the supply chain from farmer to grain elevator, transportation provider, intermediaries and end user(s). Traceability of source identity and commodity characteristics such as quality or disease are particularly important. At any point in the distribution chain, appropriate queries to CA database 44 may be made to provide one or more reports concerning the commodity. For example, a user may wish to evaluate a particular grain shipment for its reported history of disease detected by a CAS at some point in the supply chain, to identify a source (or sources) of the commodity or the geographical location (or locations) of the source of the commodity. The geographical location may be an indicator of the likelihood of the presence of a particular disease. Again, the query result may determine a use for the particular commodity.

Having more commodity analysis data readily available for commodities such as grain provides many enhancement opportunities to those working with the commodity. The data is useful for reducing health risks from diseased grain to those consuming the grain, including animals. Grains such as wheat and barley, oats and other small

cereal grains and corn may suffer a fungal disease known as Fusarium Head Blight (FHB) caused by several species of *Fusarium*. This disease reduces crop yield and grade, but more importantly, may also contaminate the grain with fungal toxins (mycotoxins). Diseased crop spikelets can contain visibly affected kernels, termed fusarium damaged kernels (FDK) in the grading of wheat or fusarium mould for barley. Wheat and barley infected with FHB may contain toxins such as deoxynivalenol (DON) also known as vomitoxin. Vomitoxin if consumed by animals, may result in reduced feed consumption or feed refusal increasing the cost of production. Rates and geographical locations of fungal infections of crops are tracked by various agencies in order to assess the risks presented to various industries, the environment and people.

More and better commodity data permits blending of grain closer to required specifications and the better matching of grain to a required end use. Certain grains exhibit better baking characteristics and may be directed to use as flour, for example. Better and more consistent grain analysis lowers the risk of downgrades at ports or other points along the distribution chain. A central data warehousing approach that collects data from geographically disperse points in a supply chain facilitates convenient value-added use and re-distribution. As such, all members in the supply chain for the commodity may be part of a common system.

In the preferred embodiment, the CACS 40 further provides a mechanism (not shown) to update a CA Program at a CAS, in whole or in part. The updates may reflect changes to previous functionality or to add new functions including

particular commodity tests. In an exemplary method of updating, on a regular basis, the version of any CA Program (e.g. neural network, training data or user interface) installed on the CAS may be compared with the latest versions of same indicated by CA Program 46 of Fig. 1 stored at CACS 40. If the version at a CAS is out of date, a notification may be made to the operator of the CAS and a new version may be automatically downloaded and installed to the CAS in accordance with conventional methods understood to persons skilled in the art. Preferably, to ensure that each CAS is always using the most current software, the operators thereof are not given an opportunity to decline a software update.

Optionally, a billing mechanism may be integrated into CACS 40 for tracking the use of each CAS for generating invoices. For example, CACS 40 may be configured to invoice routinely and automatically a CAS operator in accordance with the number and type of commodity analyses preformed and tracked during a particular time period. The billing mechanism may be configured for electronic or non-electronic notification and payment methods in accordance with conventional techniques. Preferably, invoice and reporting formats are flexible to meet customer needs.

Optionally, in order to ensure that a CAS is not used in a manner that prevents correct invoicing, operation of a CA Program may be regulated. Should a CAS continue to be operated but fail to provide regular updates of CA data to CACS 40 to trigger a billing event, that CAS may be regulated to prevent further use of the CA Program.

Many advantages to the method and system of the present invention are apparent. For example, the invention provides

a manner to conveniently generate commodity analysis data reports from dispersed analysis systems to track a commodity as it flows through a supply chain. Users may determine better uses for a commodity, directing the commodity to appropriate uses that may increase value. For example, more precise blending through more frequent sampling and more accurate analysis of those samples is enabled, resulting in reduced risk for the elevator and assuring more accurate payment to the farmers for their grain.

In addition to comprising one or more instruments for analyzing a commodity per se, a CAS computer may be coupled to one or more instruments (not shown) for measuring or acquiring other related data. For example, a global positioning sensor may be employed to provide location data particularly for portable test systems. Devices for measuring characteristics of soil, water or growing environment variables may also be used for relating to particular commodities. Data from these measurements may be incorporated as CA data for providing to the CACS.

A CAS, particularly one employing neural network or other artificial intelligence may be configured and trained for commodities other than grain. For example, a CAS may evaluate flour based on color and texture characteristics, or be trained to evaluate the quality of meats and detect a presence of a steroid from the meat fiber texture. The CAS may be trained to evaluate the quality of reproductive semen from several species, including humans. The CAS could also be used to help in the blending of grass mixtures for different turf uses. Additionally, a CAS may be trained to assess the size of feed particles after milling, the

presence of micelium of different plant diseases on leaves, the count of bacteria in water samples or the sugar content in potatoes.

As well as performing biological inspections and analysis, a CAS may be configured to perform industrial inspections. For example, the CAS could be trained to evaluate the colour consistency of white paper and, potentially, paper porosity, eliminating the hazardous use of mercury and significantly reducing cost. The CAS could be used to count or inspect small particles currently done by more expensive machine vision equipment.

The embodiment(s) of the invention described above is(are) intended to be exemplary only. The scope of the invention is therefore intended to be limited solely by the scope of the appended claims.

**I/WE CLAIM:**

1. A method of managing commodity data for a chain of production in which one or more commodities are used in one or more production steps, the method comprising the steps of:

receiving commodity data for discrete quantities of at least one commodity used or produced by the chain of production;

storing the commodity data in a data storage system; and

determining commodity information in accordance with the contents of the data storage system;

wherein said commodity data comprising, for each particular discrete quantity of one of the commodities, at least one commodity characteristic of the particular discrete quantity and wherein the commodity data is received from one or more commodity analysis systems each configured to analyze one or more commodities to determine at least one commodity characteristic and generate commodity data.

2. The method as claimed in claim 1 including the step of providing the commodity information for determining a use of at least a portion of at least one of the discrete quantities in the chain of production.

3. The method as claimed in claim 2 wherein the use is defined in accordance with a standard responsive to one or more commodity characteristics.

4. The method as claimed in claim 3 wherein the standard defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

5. The method as claimed in claim 1 wherein step of determining commodity information includes the step of tracing commodity data for particular discrete quantities as said quantities flow through said chain of production.

6. The method as claimed in claim 1 wherein the at least one commodity characteristic includes at least one measured characteristic of the particular discrete quantity.

7. The method as claimed in claim 1 wherein the at least one commodity characteristic includes at least one secondary characteristic determined for the particular discrete quantity.

8. The method as claimed in claim 1 wherein the commodity data includes one or more source data for identifying characteristics of the source of the commodity.

9. The method as claimed in claim 1 wherein the commodity data is received from one or more commodity analysis systems each configured to:

analyze one or more commodities to provide measurement data for each commodity analyzed;

examine said measurement data to determine at least one commodity characteristic; and

generate the commodity data for particular discrete quantities of the one or more commodities.

10. The method as claimed in claim 9 wherein the commodity analysis systems are configured to examine said measurement data in accordance with a library of comparative data for determining commodity characteristics.

11. The method as claimed in claim 10 wherein the commodity analysis systems are configured to use one or more neural networks for determining commodity characteristics.

12. The method as claimed in claim 9 including the step of providing electronically an update for the configuration of at least one of the commodity analysis systems.

13. The method as claimed in claim 1 including the step of providing a user interface for obtaining commodity information determined from data stored in the data storage system.

14. A method of managing commodity data for a chain of production in which one or more commodities are used in one or more process steps, the method comprising the steps of:

generating commodity data for a plurality of discrete quantities of at least one commodity used or produced by the chain of production; and

providing the commodity data for storing in a data storage system configured for receiving commodity data from a plurality of commodity analysis systems;

wherein the commodity data for each particular discrete quantity comprising at least one commodity characteristic produced by analyzing the particular discrete quantity using one of the plurality commodity analysis systems;

15. The method as claimed in claim 14 further comprising the step of determining commodity information in accordance with the contents of the data storage system.

16. The method as claimed in claim 15 further comprising the step of determining a use in the chain of production of at least a portion of at least one of the discrete quantities in response to said determined commodity information.

17. The method as claimed in claim 16 wherein the use is defined in accordance with a standard responsive to one or more commodity characteristics.

18. The method as claimed in claim 15 wherein the standard defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

19. The method as claimed in claim 15 wherein the step of determining commodity information includes tracing commodity data for particular discrete quantities as said quantities flow through said chain of production.

20. The method as claimed in claim 14 wherein the at least one commodity characteristic includes at least one measured characteristic of the particular discrete quantity.

21. The method as claimed in claim 14 wherein the at least one commodity characteristic includes at least one secondary characteristic determined for the particular discrete quantity.

22. The method as claimed in claim 14 wherein the at least one commodity characteristic includes at least one production context characteristic of the particular discrete quantity.

23. The method as claimed in claim 14 wherein the commodity analysis systems are configured to:

analyze one or more commodities to provide measurement data for each commodity analyzed;

examine said measurement data to determine at least one commodity characteristic; and

generate the commodity data for particular discrete quantities of the one or more commodities.

24. The method as claimed in claim 23 wherein the commodity analysis systems are configured to examine

said measurement data in accordance with a library of comparative data for determining commodity characteristics.

25. The method as claimed in claim 24 wherein the commodity analysis systems are configured to use one or more neural networks for determining commodity characteristics.

26. The method as claimed in claim 14 wherein the step of generating includes the step of entering commodity data using a user interface of said commodity analysis system.

27. The method as claimed in claim 26 including the step of correlating commodity data entered using the interface with commodity data produced by an analysis.

28. The method as claimed in claim 14 wherein at least one commodity analysis system is configured to periodically gather commodity data from a plurality of commodity analyses into a batch of commodity data and wherein said step of providing comprising transmitting said batch to said data storage system.

29. A method of managing a commodity analysis system for generating commodity data for a chain of production in which one or more commodities are used in one or more process steps, the method comprising the steps of:

receiving commodity data for discrete quantities of at least one commodity used or produced by the chain of production;

storing the commodity data in a data storage system; and

tracking the use of at least one of the commodity analysis systems;

wherein the commodity data comprises, for each particular discrete quantity of one of the commodities, at least one commodity characteristic of the particular discrete quantity and wherein the commodity data is received from one or more commodity analysis systems each configured to analyze one or more commodities to determine at least one commodity characteristic and generate the commodity data for particular discrete quantities of the one or more commodities.

30. The method as claimed in claim 29 including the step of transmitting an update for at least one of the commodity analysis systems.

31. The method as claimed in claim 30 wherein the at least one commodity analysis system comprises a neural network for determining the at least one commodity characteristic; and wherein the update comprises an update to the neural network.

32. The method as claimed in claim 29 including the step of invoicing in response to the tracked use of the at least one commodity analysis system.

33. A method of managing commodity data for a chain of production in which one or more agricultural commodities are used in one or more production steps, the method comprising the steps of:

receiving commodity data for discrete quantities of at least one agricultural commodity used or produced by the chain of production; and

storing the commodity data in a data storage system;

wherein the commodity data comprises, for each particular discrete quantity of one of the agricultural commodities, at least one commodity characteristic of the particular discrete quantity and wherein the commodity data is received from one or more commodity analysis systems each configured to analyze one or more agricultural commodities to determine at least one commodity characteristic and generate commodity data.

34. The method as claimed in claim 33 wherein the one or more agricultural commodities comprise at least one of a crop, an animal, a commodity derived from a crop and a commodity derived from an animal.

35. The method as claimed in claim 33 further including the step of determining commodity information in accordance with the contents of the data storage system.

36. The method as claimed in claim 35 including the step of determining a use of at least a portion of at least one of the discrete quantities in the chain of

production in response to said determined commodity information.

37. The method as claimed in claim 36 wherein the use is defined in accordance with a standard responsive to one or more agricultural commodity characteristics.

38. The method as claimed in claim 37 wherein the standard defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

39. The method as claimed in claim 35 wherein said step of determining commodity information includes the step of tracing commodity data for one or more particular discrete quantities as said quantities flow through said chain of production to examine whether a use of a particular discrete quantity of an agricultural commodity is in compliance with a standard defining one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

40. The method as claimed in claim 33 wherein the commodity data includes one or more source data for identifying characteristics of the source of the commodity.

41. The method as claimed in claim 33 wherein the commodity data is received from one or more commodity analysis systems each configured to:

analyze one or more commodities to provide measurement data for each commodity analyzed;

examine said measurement data to determine at least one commodity characteristic; and

generate the commodity data for particular discrete quantities of the one or more commodities.

42. A computerized system for managing commodity data for a chain of production in which one or more commodities are used in one or more process steps, the system comprising:

a data storage system for storing commodity data for a plurality of discrete quantities of at least one commodity used or produced by the chain of production, the commodity data for each particular discrete quantity comprising at least one commodity characteristic; and

a plurality of commodity analysis systems coupled to the data storage system for generating commodity data to be stored by the data storage system, each commodity analysis system operating under control of a program to perform commodity analysis and storage operations as identified by said program; and each commodity analysis system including at least one instrument for analyzing the commodity for determining the at least one commodity characteristic.

43. The system as claimed in claim 42 wherein said commodity analysis system further comprises a user interface for receiving commodity data for storing in said data storage system in association with commodity data determined by analysis.

44. The system as claimed in claim 42 wherein said commodity analysis system further comprising a user interface for retrieving commodity information from said data storage system.

45. The system as claimed in claim 44 wherein the commodity information is retrieved for determining a use in the chain of production of at least a portion of at least one of the discrete quantities.

46. The system as claimed in claim 44 wherein said data storage system is configured to enable tracing of commodity data as particular quantities of a commodity flow through said chain of production.

47. The system as claimed in claim 42 wherein the instrument is configured for determining at least one commodity characteristic for evaluating compliance with a commodity standard.

48. The system as claimed in claim 47 wherein the commodity standard defines one of an identity preservation program, a specialty trait tracking program and a food safety certification program.

49. The system as claimed in claim 42 wherein the at least one commodity characteristic includes at least one measured characteristic of the particular discrete quantity.

50. The system as claimed in claim 42 wherein the at least one commodity characteristic includes at least

one secondary characteristic determined for the particular discrete quantity.

51. The system as claimed in claim 42 wherein the commodity data includes at least one production context characteristic of the particular discrete quantity.

52. The system as claimed in claim 42 wherein the commodity analysis systems are configured to:

analyze one or more commodities to provide measurement data for each commodity analyzed;

examine said measurement data to determine at least one commodity characteristic; and

generate the commodity data for particular discrete quantities of the one or more commodities.

53. The system as claimed in claim 52 wherein the commodity analysis systems are configured to examine said measurement data in accordance with a library of comparative data for determining commodity characteristics.

54. The system as claimed in claim 53 wherein the commodity analysis systems are configured to use one or more neural networks for determining commodity characteristics.

55. The system as claimed in claim 42 wherein at least one commodity analysis system is configured to periodically gather commodity data from a plurality of commodity analyses into a batch and transmit the

batch to said data storage system for storing said commodity analysis data.

56. A computer program product having instructions for directing a computer system to implement any one of the methods of claims 1 to 41.

**ABSTRACT**

There is provided a computerized method and system for managing commodity data for a chain of production in which one or more commodities are used in one or more production steps. Commodity data for a particular quantity of a commodity are generated by commodity analysis systems at points in the supply chain and provided to a central data storage system. The commodity data may be traced as the particular quantities of the commodity flow through the chain of production. The commodity data preferably includes commodity characteristics defined in accordance with commodity standards such as specialty trait tracking programs, identity preservation programs and food safety programs in the agri-food industries.

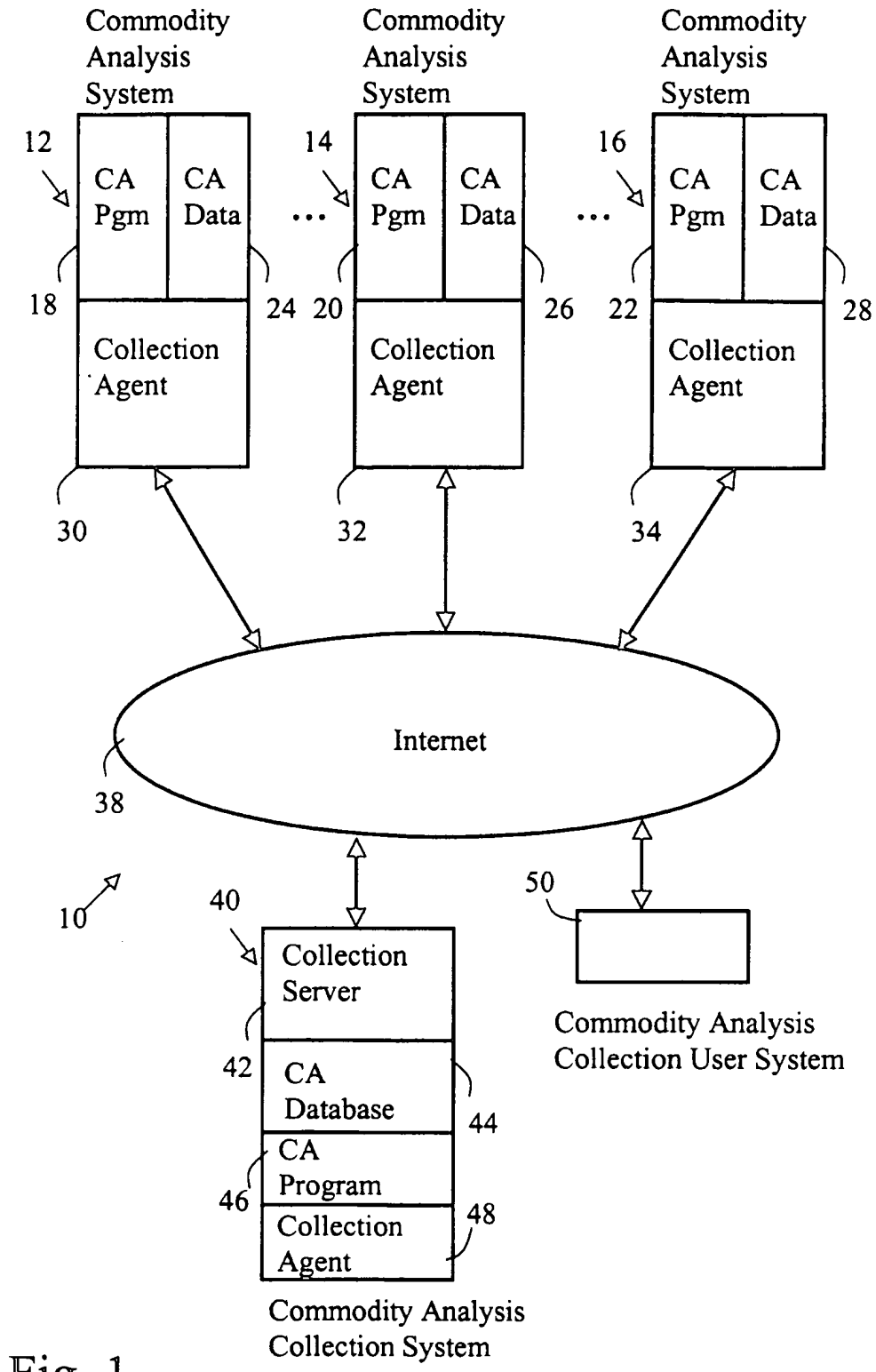
Commodity Analysis System
12
CA Pgm
CA Data
18
24
Collection Agent
30
Commodity Analysis System
14
CA Pgm
CA Data
20
26
Collection Agent
32
Commodity Analysis System
16
CA Pgm
CA Data
22
28
Collection Agent
34
Internet
38
10
40
Collection Server
42
CA Database
44
CA Program
46
Collection Agent
48
Commodity Analysis Collection System
50
Commodity Analysis Collection User System

Fig. 1

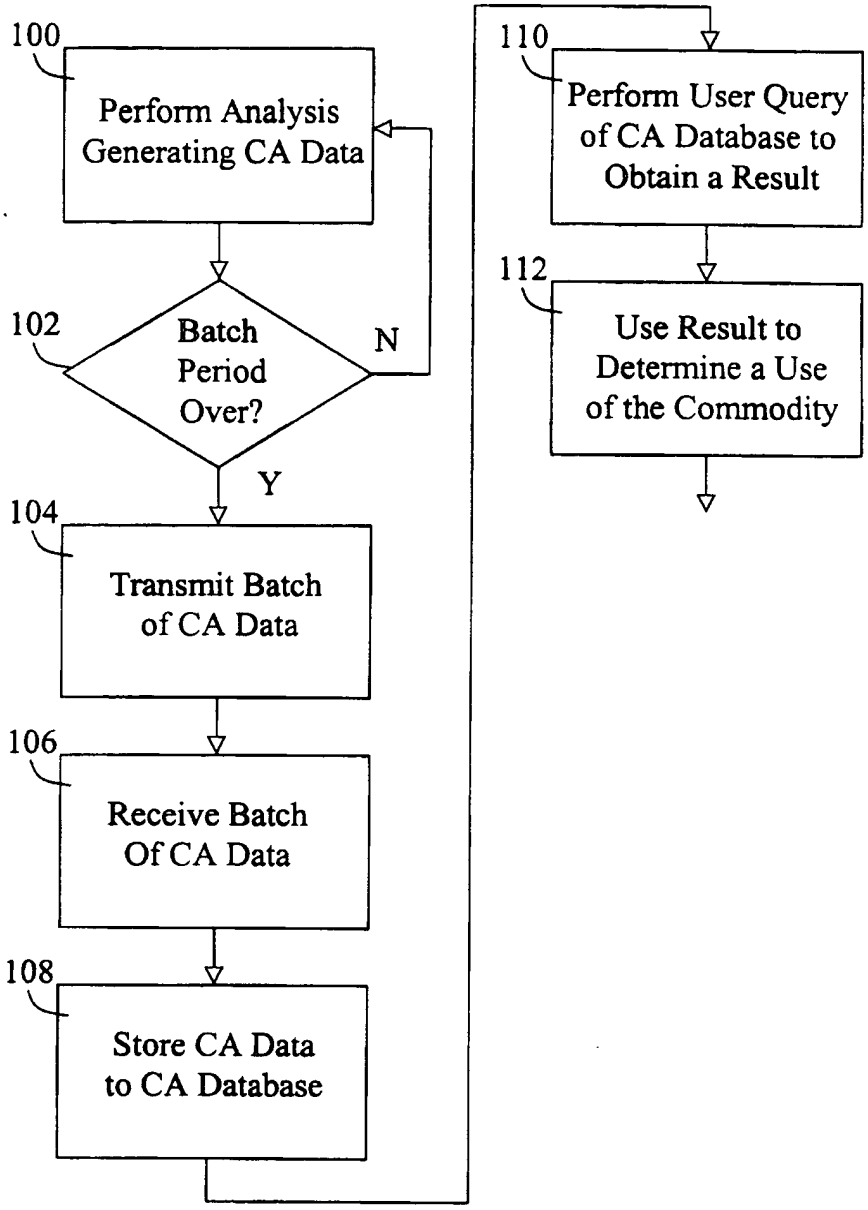
100
Perform Analysis Generating CA Data
102
Batch Period Over?
N
Y
104
Transmit Batch of CA Data
106
Receive Batch Of CA Data
108
Store CA Data to CA Database
110
Perform User Query of CA Database to Obtain a Result
112
Use Result to Determine a Use of the Commodity

Fig. 2